

8/8/91

SEQUENCE

RECOMMENDED BURNER REPLACEMENT SCHEDULE:

1. ~~New~~ B&W Burner Design

- Making 9/16*
- a. Release burner for detail design and drawings (B&W)
  - b. Conduct Finite Element Analysis (RJM)
  - c. Determine material selection for burners
  - d. Release for Material Purchase (B&W) & Fabrication
  - e. Conduct Axisymmetric (2D) Air Flow Model (RJM) and determine register setup parameters
  - f. Conduct Flame Stabilizer design analysis (RJM)
  - g. Evaluate NOx emissions based on aerodynamic changes to flames (RJM)

2. Flame Stabilizers

- 10/20/90*
- a. Fabricate Stabilizers (RJM) (48) 10 week lead time
  - b. Install Stabilizers on Unit 2 ~~Spring~~ Outage
  - c. Test and Evaluate following outage

3. Three Dimensional Air Flow Modeling

- a. Conduct 3-D mathematical air flow model
- b. Evaluate and implement changes on (Unit 2 Fall Outage)

4. Fuel Flow Balancing (IPSC)

- a. Conduct air flow testing on Unit 2
- b. Balance fuel flow with restrictor changeouts  
Unit 2 on pulverizer basis (no outage required)

*Outage* 5. Secondary Air Flow Balancing

- a. Conduct air flow balancing on Unit 2 Fall Outage (requires all burners setup the same (based on 2-D model) with unit off line, also includes banding outer registers to achieve balance)

6. Combustion Testing

- a. Conduct combustion testing evaluation
- b. Conduct boiler performance testing
- c. Evaluate burner and unit performance

7. Burner Design Evaluation

- a. Evaluate burner design and its effectiveness *shutdown temperatures / cool down*
- b. Evaluate effectiveness of flame stabilizers (RJM concept)

8. Burner Installation

- a. Install all 48 burners on Unit 1 Spring Outage
- b. Rebalance secondary air flows
- c. Install flame stabilizers *Unit 2*
- d. Test and evaluate Unit 1 installation
- e. Install all 48 burners on Unit 2 (When?) *deferred*

**PRELIMINARY**

IPP UNITS 1 AND 2  
BURNER IMPROVEMENT PROGRAM

I. STEP ONE- OPERATIONAL IMPROVEMENT

1. PERFORM 2D AND 3D COMPUTER AIR FLOW MODELING OF BURNERS AND WINDBOX. (RJM)
2. BALANCE THE SECONDARY AIR FLOW FROM BURNER TO BURNER WITHIN PLUS OR MINUS 3% (DESIGN AND INSTALL SHROUDS) (RJM, B&W) *before - after*
3. INSTALL COMPARTMENTAL METERING TO THE WINDBOXES. (B&W)
4. INSTALL DUAL SCANNERS. (B&W) *? 3D? - 4? Don't for infinite analysis*
5. RELOCATE AND ADD THERMOCOUPLES TO THE BURNERS. (B&W)
6. INCREASE COOLING AIR TO OUT OF SERVICE BURNERS AND MAINTAIN A MAXIMUM BURNER METAL TEMPERATURE OF 1250F. (B&W, IPSC) *Don't resolve problem*
7. TUNE THE BURNERS USING AGASS BASED ON AN AVERAGE EXCESS O2 LEVELS OF 3.2% PLUS OR MINUS 0.75% (IPSC, B&W, RJM)

II. STEP TWO- EVALUATE BURNER AND UNIT PERFORMANCE

1. BURNER PERFORMANCE (LOI?, EYEBROWS? METAL TEMP.? BINDING?)
2. UNIT PERFORMANCE (EFFICIENCY?)

III. STEP THREE- BURNER DESIGN IN PARALLEL TO STEP ONE

1. RELEASE B&W FOR DETAIL DESIGN OF PROPOSED BURNER (ALREADY IN PROGRESS)
2. DO A FINITE ELEMENT ANALYSIS ON THE NEW BURNER. (ALREADY IN PROGRESS)
3. MATERIAL SELECTION (310SS VS 800H).
4. FLAME AERODYNAMICS (B&W, RJM)

IV. STEP FOUR- INSTALL A TEST BURNER

1. BASED ON THE RESULTS OF THE FINITE ELEMENT ANALYSIS FABRICATE AND INSTALL A TEST BURNER ON UNIT 1 OR 2 DURING THE SPRING 1992 OUTAGE.
2. INSTRUMENT THIS BURNER AND COLLECT FIELD DATA.
3. EVALUATE BURNER THERMAL GROWTH, REGISTER OPERABILITY, AND IDENTIFY OPTIMUM THERMOCOUPLE LOCATIONS.

V. STEP FIVE- FINALIZE BURNER DESIGN

1. BASED ON FIELD DATA FINALIZE BURNER DESIGN

VI. STEP SIX- EVALUATE RJM FLAME STABILIZER

1. RJM WILL BE INSTALLING FLAME STABILIZER SOMETIME NEXT YEAR AT ANOTHER UTILITY.
2. MONITOR PERFORMANCE OF THE FLAME STABILIZER.
3. EVALUATE PERFORMANCE.

VII. STEP SEVEN- FINAL EVALUATION

1. COMPLETE EVALUATION OF ALL MODIFICATIONS.
2. COMPLETE EVALUATION OF BURNER DESIGN.
3. COMPLETE EVALUATION OF REPLACING THE BURNERS.

*note: test RJM [hand bought out]  
a different approach than B&W  
(now our nickel  
look at other alternatives)*

IPP UNITS 1 AND 2 BURNER MEETING

August 8, 1991, 9 a.m.  
Mezzanine Conference Room

OPENING - C. L. DeVore

WHERE ARE WE NOW?

- o We have an approved Budget item
- o Present schedule and tasks (refer to handout) - MES
  - o Likelihood of doing?
  - o B&W Design Status?
  - o Need B&W committment to furnish all 48
  - o Concerns, warranty, acceptance of responsibility
  - o
  - o

BURNER IMPROVEMENT PROGRAM PROPOSAL (refer to handout) - MES

- o Goals
- o Furnish information to validate finite analysis
- o Use in design, basis to improve burner life
- o Means to evaluate modifications
  - Shrouds
  - Swirlers
- o Costs and schedules
- o Plan for burners till full replacements
  - o Fall '91 outage
  - o Spring '92 outage
- o
- o

IPSC CONCERNS

- o
- o
- o

SUMMARY/CONCLUSIONS

CLD:hl  
8-7-91

## PRESENT SHEDULE AND TASKS

AT THE PRESENT WE ARE PROCEEDING WITH THE IDEA THAT WE WILL BE REPLACING ALL 48 BURNERS ON UNIT 1.

THE FOLLOWING IS THE LIST OF TASKS WITH THEIR RESPECTIVE SHEDULES IN ORDER TO MEET THE UNIT 1 SPRING 1992 OUTAGE. THIS SCHEDULE IS BEING REVIEWED BY B&W AND THEIR RESPONSE IS DUE BY FRIDAY AUGUST 8, 1991.

RELEASE FOR ENGINEERING	B&W	8- 5-91 ✓
	RJM	8- 5-91 ✓ <i>B&amp;W send drawing to RJM</i>
FINALIZE BURNER DRAWINGS	B&W	8-26-91
FINITE ELEMENT ANALYSIS START	RJM	8-26-91
FINITE ELEMENT ANALYSIS RESULTS FOR MATERIAL SELECTION	RJM	9-16-91
MATERIAL SELECTION START	DWP/IPSC/B&W	9-16-91
FINISH		9-20-91
MATERIAL ORDER (48 burners) DELIVERY	B&W	9-23-91 11-22-91
RESULTS OF FINITE ELEMENT	RJM	11-04-91
REVIEW OF FINITE ELEMENT ANALYSIS	DWP/IPSC/B&W	11-15-91
RELEASE FOR FABRICATION	DWP	11-15-91
FABRICATION START	B&W	11-25-91
FINISH	B&W	3- 1-92
SPRING OUTAGE START		3-23-92
FINISH		4-18-92
INSTALLATION START	B&W	3- 1-91
FINISH	B&W	4-18-92
BURNER START-UP AND TUNING	IPSC/B&W/RJM	4-18-92

*No Burners Fall*

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Les Lovell

PHASE 1 RJM BURNER EVALUATION

The Burner Design Evaluation will consist of the following:

1. Conduct Mechanical Design Evaluation \$27,000
  - a. Develop CAD model of burner
  - b. Conduct finite element analysis

Objective: • Minimize thermal expansion related damage to the burners.

2. Conduct 2-dimensional axisymmetric air flow model \$9,000

Objectives: • Establish proper swirl characteristics.  
• Determine outer register, inner register and backplate position settings to meet air flow requirements.

3. Design Coal Flame Stabilizer \$7,200

Objectives: • Determine flame stabilizer design requirements and incorporate into mechanical design evaluation, air flow model and NOx evaluation.

4. Conduct NOx emissions evaluation \$1,000

Objectives: • Conduct NOx combustion evaluation to ensure recommendations on modifications to the burners do not increase NOx emission levels.

ESTIMATED COSTS for burner design evaluations \$44,200  
plus travel for meetings requested by IPSC \$ 2,000

TOTAL \$46,200